APPENDIX A

SPONSOR LETTER OF INTENT, FINANCIAL CAPABILITY ASSESSMENT AND O&M AGREEMENT

MISSOURI DEPARTMENT OF CONSERVATION

Headquarters

2901 West Truman Boulevard, P.O. Box 180, Jefferson City, Missouri 65102-0180
Telephone: 573/751-4115 ▲ Missouri Relay Center: 1-800-735-2966 (TDD)

JOHN D. HOSKINS, Director

June 20, 2003

Mr. David E. Leake
Chief, Planning & Project Development Branch
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, MO 63103-2833

Dear Mr. Leake:

The Missouri Department of Conservation (Department) supports the U.S. Army Corps of Engineers (COE) project for ecosystem restoration at the Schenimann Chute Side Channel Area, Cape Girardeau County, Missouri. The project would help restore the structure and functions of this aquatic habitat complex that has been adversely impacted by prior river sedimentation. This restoration will involve the notching of existing stone dikes, construction of stub dikes and/or hard points, placement of revetment and the dredging of sand at the lower end of the chute to improve connectivity with the river. This work would be accomplished under the authority of Water Resources Development Act of 1986 (Section 1103), as amended. The Department understands that the current total estimated first cost of the project is $2,768,400 and that the annual operation and maintenance costs are estimated to be $8,557.

It is the Department's understanding that under the federal endangered species habitat provisions of the Environmental Management Program, this project will be constructed at 100 percent federal cost; however, once completed, the project's operation and maintenance will be the Department's responsibility. It is also understood that a Memorandum of Agreement (MOA) rather than a Project Cooperative Agreement (PCA) will be necessary for this project. I have reviewed a draft of the MOA and it is our intent to enter into the agreement when the document is finalized and has been reviewed by our general counsel.

If you need additional information from the Department regarding our participation in this project, please feel free to contact me at (573) 522-4115 Ext. 3372.

Sincerely,

Janet E. Sternburg
Policy Coordinator

c: Dr. Dan Witter—Policy Coordination Section Chief

COMMISSION

STEPHEN C. BRADFORD, Cape Girardeau
ANITA B. GORMAN, Kansas City
CYNTHIA METCALFE, St. Louis
HOWARD L. WOOD, Bonne Terre

SCHENIMANN CHUTE SIDE CHANNEL PROJECT

SECTION 1103, WRDA 1986

AQUATIC ECOSYSTEM RESTORATION
AT CAPE GIRADEAU COUNTY, MISSOURI

ASSESSMENT OF PROJECT SPONSOR'S FINANCIAL CAPABILITY

The Local Sponsor for this Project, the Missouri Department of Conservation (MDOC), has indicated their intent to provide the non-Federal cost-share for this project as defined in the Planning and Design Analysis (PDA) report.

The total estimated cost of the ecosystem restoration project is $2,768,400. The project will be constructed at 100 percent federal first costs; however, once completed, the project's operation and maintenance will be the total responsibility of MDOC. A Memorandum of Agreement (MOA) rather than a Project Cooperative Agreement (PCA) will be signed between MDOC and COE.

I have received a letter of comment on the study report, and a Letter of Intent from the Local Sponsor concurring with the plans for the work and advising that it is willing to assume responsibility for the project's operation and maintenance work, as required, and in accordance with Section 1103 of WRDA 1986 (as amended).

I feel confident, and have concluded that, the Department of Conservation, State of Missouri, is financially capable to meet the Project's non-Federal financial obligations, and is willing and able to serve as the Local Sponsor for this project.

Charles K. Williams
Colonel, U. S. Army
District Engineer

MEMORANDUM OF AGREEMENT
BETWEEN
THE MISSOURI DEPARTMENT OF CONSERVATION
AND
THE DEPARTMENT OF THE ARMY
FOR
ENHANCING FISH AND WILDLIFE RESOURCES
OF THE
UPPER MISSISSIPPI RIVER SYSTEM
AT
SCHENIMANN CHUTE SIDE CHANNEL, MISSOURI

I. PURPOSE

The purpose of this memorandum of agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the Missouri Department of Conservation (MDOC) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Schenimann Chute Side Channel separable element of the Upper Mississippi River System – Environmental Management Program (UMPS-EMP).

a. BACKGROUND

b. Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. Under conditions of Section 906 (e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features for the Schenimann Chute Side Channel Project are 100 percent Federal and pursuant to Section 107 (b) of the Water Resources Development Act of 1992, Public Law 102-580, all costs of operation and maintenance for the Schenimann Chute Side Channel project area are 100 percent Non-Federal.

c. GENERAL SCOPE

Immediate and long term ecosystem improvements and provide off-channel habitat for over wintering, spawning, and rearing fishes, particularly, the endangered pallid sturgeon. The project is to be accomplished pursuant to this MOA shall consist of the construction of multiple hardpoints, notches in existing pile and stone dikes, and dredging of the southern portion of the Schenimann Chute side channel.

d. RESPONSIBILITIES

a. DOA is responsible for:

1. Construction. Construction of the project which consists of constructing the aforementioned project features.

2. Major Rehabilitation. The Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the definite project report and that is needed as a result of specific storm or flood events, that exceed the project's design.

3. Construction Management. Subject to and using funds appropriated by the Congress of the United States, [and in accordance with Section 906 (e) of the Water Resources Development Act of 1986, Public Law 99-662,] DOA will construct the Schenimann Chute Side Channel Project as described in the planning design analysis report, "Schenimann Chute Side Channel Habitat Rehabilitation and Enhancement Project," dated June 2002, applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The MDOC will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If DOA encounters potential delays related to construction of the project, DOA will promptly notify MDOC of such delays.

4. Maintenance of Records. The DOA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. The DOA shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of the project and resolution of all relevant claims arising there from, and shall make available at its offices, at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the MDOC.

a. MDOC Responsibilities:

1. Upon completion of construction as determined by the District Engineer, St. Louis, the MDOC shall accept the project.

2. In accordance with Section 107 (b) of the Water Resources Development Act of 1992, Public Law 102-580, 100 percent of all costs associated with the operation, maintenance, and repair of the Schenimann Chute Side Channel Project, shall be borne by a non-federal sponsor. The MDOC shall be responsible for the execution and management of an appropriate agreement with a non-federal sponsor for this purpose. The project shall be operated, maintained and repaired as defined in the Planning Design and Analysis (PDA) Report entitled "Schenimann Chute Side Channel Habitat Rehabilitation and Enhancement Project, " dated May 2002.

3. The project shall be monitored as defined in the Planning Design and Analysis (PDA) Report entitled "Schenimann Chute Side Channel Habitat Rehabilitation and Enhancement Project, " dated May 2002.

a. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 15 years after initiation of construction of the project.

b. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties.

MDOC: Director

Missouri Department of Conservation
2101 West Truman Boulevard, P.O. Box 180
Jefferson City, Missouri 65102-0180

DOA: District Engineer
U.S. Army Engineer District, St. Louis
1222 Spruce Street
St. Louis, Missouri 63103-2833

I. EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY	THE MISSOURI DEPARTMENT OF CONSERVATION
BY: _____ (signature)	BY: _____ (signature)
CHARLES K. WILLIAMS Colonel, Corps of Engineers St. Louis District	JOHN HOSKINS Director U. S. Fish and Wildlife Service
DATE: _____	DATE: _____

APPENDIX B

CORRESPONDENCE PERTAINING TO DRAFT PDA

This appendix of the Final PDA/EA will include the letters of comment received during the public review of the Draft PDA/EA. Also included will be the St. Louis District's responses to those letters of comment.

MISSOURI DEPARTMENT OF CONSERVATION

Headquarters

2901 West Truman Boulevard, P.O. Box 180, Jefferson City, Missouri 65102-0180

Telephone: 573/751-4115 ▲ Missouri Relay Center: 1-800-735-2966 (TDD)

JERRY M. CONLEY, Director

August 16, 2001

Mr. Owen Dutt
St. Louis District, Corps of Engineers
1222 Spruce Street
St. Louis, MO 63103-2833

Dear Mr. Dutt:

Re: Schenimann Chute Habitat Rehab and Enhancement
Cape Girardeau County, Missouri

Thank you for your letter of August 16, 2001, regarding species of conservation concern within the proposed project area.

A review of our records shows that public lands, sensitive species or communities are known to exist on or near the above referenced site. Details are provided in the enclosed Heritage Database report which reflects information we currently have in our database. Please be advised this is **not a site clearance letter**. Rather, this letter provides an indication of whether or not public lands and sensitive resources are known to be (or are likely to be) located close to the proposed project.

Incorporating information from our Heritage Database into project plans is an important step that can help reduce unnecessary impacts to Missouri's sensitive natural resources. However, the Heritage Database is only one reference which should be used to evaluate potential adverse impacts. Other types of information, such as wetland and soils maps and on-site inspections or surveys, should be considered. Reviewing current landscape and habitat information and species biological characteristics would additionally ensure that species of conservation concern are appropriately identified and addressed.

Impacts to the aquatic environment should be minimal if the following best management practices for maintaining water quality are followed during project design and construction.

1. Channel modification or stream relocation should not occur unless conditions of the State Channel Modification Guidelines are met.

2. Grade and seed disturbed areas as soon as possible to minimize erosion. Missouri Department of Conservation seeding and planting recommendations can be provided to enhance site conditions.

3. Disturbance to streambanks and riparian areas should be avoided.

COMMISSION

STEPHEN C. BRADFORD, Cape Girardeau · ANITA B. GORMAN, Kansas City · CYNTHIA METCALFE, St. Louis · HOWARD L. WOOD, Bonne Terre

4. Stream flows should not be interrupted. All temporary inchannel fills that could impound water should be culverted.

5. Avoid work in the channel between March 15 and June 15 to the extent possible.

6. Take all necessary precautions to prevent petroleum products from entering the stream.

Thank you for the opportunity to review and comment.

Sincerely,

Gene Gardner

GENE GARDNER
POLICY COORDINATOR

GG:dcl

Enclosure

c: Gary Christoff
Mark Haas

ST. LOUIS DISTRICT, CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MO 63103-2833

SCHENIMANN CHUTE HABITAT REHAB AND ENHANCEMENT
CAPE GIRARDEAU COUNTY, MISSOURI

The following species and/or natural communities are known to occur on or in the vicinity of the project site:

Scientific Name	Common Name	Federal Status	State Status	State Rank	Size/ Acres	Township/ Range	Sec.	Ownership
CAREX TEXENSIS	A SEDGE			S1		032N014E	10	DNR
ASTER DUMOSUS VAR STRICTIOR	TRADESCANT ASTER			S2		030N014E	05	PRIVATE
HIODON TERGISUS	MOONEYE			S3		031N015E	18	PRIVATE
MACRHYBOPSIS MEEKI	SICKLEFIN CHUB	C		S3		031N015E	07	PRIVATE
MACROBRACHIUM OHIONE	FRESHWATER SHRIMP			S1		030N014E	21	PRIVATE
CYCLEPTUS ELONGATUS	BLUE SUCKER			S3		031N014E	18	PRIVATE
MACRHYBOPSIS MEEKI	SICKLEFIN CHUB	C		S3		033N014E	33	PRIVATE
CYCLEPTUS ELONGATUS	BLUE SUCKER			S3		030N014E	17	PRIVATE
CYCLEPTUS ELONGATUS	BLUE SUCKER			S3		032N014E	13	PRIVATE
PERCINA SHUMARDI	RIVER DARTER			S3		031N015E	18	PRIVATE
SCAPHIRHYNCHUS ALBUS	PALLID STURGEON	E	E	S1		031N015E	07	PRIVATE
MACROBRACHIUM OHIONE	FRESHWATER SHRIMP			S1		031N014E	28	PRIVATE
NOTROPIS BUCHANANI	GHOST SHINER			S2		031N015E	18	PRIVATE
PERCINA SHUMARDI	RIVER DARTER			S3		033N014E	33	PRIVATE
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	T	E	S2		030N014E	16	PRIVATE
POLYODON SPATHULA	PADDLEFISH			S3		030N014E	21	PRIVATE
ICTINIA MISSISSIPPIENSIS	MISSISSIPPI KITE			S2		030N014E	17	PRIVATE
OPSOPOEODUS EMILIAE	PUGNOSE MINNOW			S4		030N014E	20	PRIVATE
STERNA ANTILLARUM ATHALASSOS	INTERIOR LEAST TERN	E	E	S1		030N014E	17	PRIVATE

FEDERAL STATUS - The federal status is derived from the provisions of the federal Endangered Species Act, which is administered by the U.S. Fish and Wildlife Service. The Endangered Species Act provides federal protection for plants and animals listed as Endangered or Threatened. E = Endangered, T = Threatened, C = Candidate, PE = Proposed Endangered for Federal listing.

STATE STATUS (E) - The state status is determined by the Department of Conservation under constitutional authority. Rule 3CSR10-4.111Endangered Species of the *Wildlife Code of Missouri* and certain state statutes apply to state Endangered species.

STATE RANK - A numeric rank of relative endangerment based primarily on the number of occurrences of the species within the state of Missouri. S1 = Critically imperiled in the state, S2 = Imperiled in the state, S3 = Rare and uncommon in the state.

Eastern collared lizard populations, natural communities and geologic features are recognized as sensitive biological resources and may also appear on this report.

ST. LOUIS DISTRICT RESPONSES

TO

MDOC LETTER REGARDING SPECIES OF CONSERVATION CONCERN

DATED: 16 AUGUST 2001

DISTRICT RESPONSE:

The Schenimann Chute HREP is strictly aquatic, and thus no impacts are anticipated to occur to terrestrial species. The project is attempting to restore the side channel in order to increase habitat diversity in this river reach. Any negative direct impacts of project construction (e.g. short term increased turbidity) will by far be outweighed by the positive effects of resultant increased habitat diversity.

The project is consistent with the State of Missouri Channel Modification Guidelines in that only short term impacts due to bank stabilization, dredging, and dike modification are expected.

We anticipate that some of the work may take place during high water periods between March 15th to June 15th in order that access to the side channel can be made via water rather than land access. If land access is necessary, precautions will be taken to prevent upland erosion from occurring, such as seeding disturbed areas.

APPENDIX C

PDA DISTRIBUTION LIST

PLANNING AND DESIGN ANALYSIS REPORT
DISTRIBUTION LIST

SCHENIMANN CHUTE SIDE CHANNEL AREA
CAPE GIRARDEAU COUNTY, ILLINOIS

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APPENDIX D

FISH AND WILDLIFE COORDINATION ACT
AND
ENDANGERED SPECIES DOCUMENTATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Marion Illinois Suboffice (ES)
8588 Route 148
Marion, IL 62959
(618) 997-3344

September 21, 2001

Colonel Michael R. Morrow
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, Missouri 63103-2833

ATTN: Mr. Eric Laux, CEMVS-PM-EA

Dear Colonel Morrow:

This letter constitutes our Draft Fish and Wildlife Coordination Act Report (DFWCAR) for the Schenimann Chute Habitat Rehabilitation and Enhancement Project (HREP). Schenimann Chute is located in Cape Girardeau County, Missouri, between Upper Mississippi River miles 63.0 and 57.0, a part of the Middle Mississippi River (MMR). This report is intended to provide partial compliance with Subsection 2(b) of the Fish and Wildlife Coordination Act, (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and Section 7 of the Endangered Species Act of 1973, as amended.

The Schenimann Chute HREP is a component of the Upper Mississippi River System Environmental Management Program (EMP) originally authorized by Section 1103 of the Water Resources Development Act (WRDA) of 1986. The goal of EMP is to implement "numerous enhancement efforts. . . . to preserve, protect, and restore habitat that is deteriorating due to natural and man-induced activities." Section 906 of WRDA 1986 states that such habitat restoration projects can be funded at 100 percent federal cost share for endangered species. The Schenimann Chute HREP is being constructed to enhance habitat diversity for the benefit of the endangered pallid sturgeon. It also provides additional habitat benefits for the endangered least tern, threatened bald eagle and many other large river fish species.

INTRODUCTION

Schenimann Chute side channel complex extends along a 6-mile stretch of the Upper Mississippi River, between river miles 63.0 and 57.0. The chute is located 5 miles north of the town of Cape

Girardeau, Missouri. Schenimann Chute provides vital backwater habitat for fish and wetland species. Some of the functions provided include spawning, rearing, resting, feeding and over-wintering habitat.

Historical Survey Maps of the Mississippi River dated 1908 indicate this reach of river contained substantial habitat and depth diversity. Important habitats included Picayune Chute, Devil's Island and Chute, Swift Sure Towhead and numerous small sand and willow islands. Schenimann Chute did not exist at the time. Aerial photographs from 1932 and 1935 depict newly constructed river training structures (wingdams) on both the Missouri and Illinois banklines (USACE 2000). Thus, Schenimann Chute was created as a result of sediment accretion between these river training structures. In addition, Swift Sure Towhead has accreted to connect with Devil's Island. The many small sand and willow islands in the area have been eliminated and the original Picayune Chute has disappeared. With ongoing sediment accretion between wingdams and the loss of many small sand islands, the result has been an overall net loss of habitat diversity in this river reach.

A sedimentation study was completed in order to evaluate a number of environmental design alternatives and modifications in the Schenimann Chute complex. The study utilized a physical hydraulic micro-model as a means to aid environmentalists, biologists and engineers in creating more diverse physical and ecological habitats throughout the study reach. The results of this study are summarized in a report by the Corps of Engineers (Corps) dated May 2000.

RESOURCE PROBLEMS AND OPPORTUNITIES

The MMR historically had a meandering pattern and shifted its course over the years, leaving oxbow lakes and backwaters (Theiling 1999). The undeveloped river was shallow and characterized by a series of runs, pools and channel crossings that provided a diversity of depth (Theiling 1999). In 1824, the MMR surface area totaled 109 mi^2 (87.2% riverbed, 12.8% islands) (Simons et al. 1974). In 1796, Collot (1826) surveyed the river and mapped 55 side channels. His historical account describes a very dynamic system with the capability to create and maintain a diversity of habitat types. In describing the great potential for change in the MMR, Collot wrote:

"The Mississippi River has not only the inconvenience of being of an immense extent, of winding in a thousand different directions, and of being intercepted by numberless islands; its current is likewise extremely unequal, sometimes gentle, sometimes rapid; at other times motionless; which circumstances will prevent, as long as both sides remain uninhabited, the possibility of obtaining just data with respect to distances. But an insurmountable obstacle will always be found in the instability of the bed of this river, which changes every year; here a sharp point becomes a bay; there an island disappears altogether. Further on, new islands are formed, sandbanks change their spots and directions, and are replaced by channels; the simuosities of the river are no longer the same; here where it once made a bend it now takes a right direction, and there a

straight line becomes a curve; here ravages and disorders cannot be arrested or mastered by the hand of man, and it would be extreme folly to undertake to describe them, or to pretend to give a faithful chart of this vast extent of waters, as we have done for the course of the Ohio, since it would not only be useless but dangerous."

Today, the natural meandering processes of the MMR have been altered through channelization. Wingdams, revetments, closing structures and bendway weirs have fixed the channel in place, disrupting the dynamic processes that create and maintain a diversity of habitat types. By 1968, the river surface area had declined to 100 mi^2 and the river width to an average 3200 feet (Simons et al. 1974). Today only 25 side channels remain (USACE 1999b). Recent studies by Theiling et al. (2000) indicate that river surface area and width continues to decline and side channels continue to be lost.

The objective of the Schenimann Chute HREP is to increase environmental diversity in the area by forming more shallow and deepwater environments along with maintaining areas with both fast and slow current. Proposed actions to enhance the chute include cutting notches in existing stone dikes, installation of hard points, placement of stone revetment, dredging approximately 75,000 cubic yards of sand at the south end, and placement of a chevron south of the chute. Notching dikes is expected to increase flow during periods of low water, thereby enhancing connectivity. Placement of 15 hard points is expected to form scour holes and induce sinuosity within the channel. Stone revetments are planned to be installed below ordinary high water. Dredging sand from the south end will increase depth and physical diversity and offer access to over-wintering habitat for fish during times of low flow. Placement of the chevron near the south end of the chute offers shallow water and island habitat with flow diversity.

THREATENED AND ENDANGERED SPECIES

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies are required to obtain from the Fish and Wildlife Service (Service) information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action. The following list of species have ranges that include the concerned area:

Classification	Common Name	Scientific Name	Habitat
Threatened Proposed to be delisted	Bald eagle	*Haliaeetus leucocephalus*	Breeds and winters along major rivers and large reservoirs
Endangered	Indiana bat	*Myotis sodalis*	Caves mines; small stream corridors with well developed woods; upland forests

Endangered	Least tern	*Sterna antillarum*	Bare alluvial and dredge spoil islands
Endangered	Pallid sturgeon	*Scaphirhynchus albus*	Rivers

There is no designated critical habitat in the project area at this time.

The bald eagle is listed as breeding and/or wintering in counties bordering the MMR. During the winter, this species feeds on fish in open water areas including those created by dam tailwaters, the warm water effluents of power plants, municipal and industrial discharges, or in power plant cooling ponds. The more severe the winter and the greater the ice coverage, the more concentrated the eagles become. They roost at night in groups in large trees adjacent to the river in areas that are protected from the harsh winter elements. They perch in large shoreline trees to rest or feed on fish. Bald eagles nest in large trees with an unobstructed view of the surrounding area. Two bald eagle nests are located in the vicinity of the project area. A nest was observed in 1998 just upstream at approximate river mile 66.5 on the Illinois side of the river. Another nest was observed in 1998 downstream on Marquette Island at approximate river mile 49.0. The eagle may not be harassed, harmed, or disturbed when present nor may nest trees be cleared.

Indiana bats are considered to potentially occur in any area with forested habitat. Indiana bats migrate seasonally between winter hibernacula and summer roosting habitats. Winter hibernacula include caves and abandoned mines. Females form nursery colonies under the loose bark of trees (dead or alive) and/or cavities, where each female gives birth to a single young in June or early July. A maternity colony may include from one to 100 individuals. A single colony may utilize a number of roost trees during the summer, typically a primary roost tree and several alternates. Some males remain in the area near the winter hibernacula during the summer months, but others disperse throughout the range of the species and roost individually or in small numbers in the same types of trees as females. The species or size of trees does not appear to influence whether Indiana bats utilize a tree for roosting provided the appropriate bark structure is present. However, the use of a particular tree does appear to be influenced by weather conditions such as temperature and precipitation. During the summer, the Indiana bat frequents the corridors of small streams with well-developed riparian woods as well as mature upland forests. It forages for insects along stream corridors, within the canopy of floodplain and upland forests, over clearings with early successional vegetation (old fields), along the borders of crop lands, along wooded fence rows, and over farm ponds and in pastures. It has been shown that the foraging range for the bats varies by season, age and sex and ranges up to 81 acres (33 ha). To avoid impacting this species, tree clearing activities should not occur during the period of April 1 to September 30. If it is necessary to clear trees during this time frame, mist net surveys may be necessary to determine if Indiana bats are present.

The least tern occurs in several counties along the Mississippi and Ohio Rivers. It nests on bare alluvial or dredge spoil islands and sand/gravel bars in or adjacent to rivers, lakes, gravel pits and cooling ponds. It nests in colonies with other least terns and sometimes with the piping plover. This species forages in shallow water areas along the river and in backwater areas, such as, side channels and sloughs. Foraging habitat must be located in close proximity to nesting habitat. Least terns are known to nest downstream of the project area on Marquette Island. It must not be harmed, harassed or disturbed when present.

Forbes and Richardson (1905), Schumulbach et al. (1975), Kallemeyn (1983), and Gilbraith et al. (1988) describe the pallid sturgeon as being a fish well adapted to life on the bottom in swift waters of large, turbid, free-flowing rivers. Pallid sturgeon evolved in the diverse environments of the Missouri and Mississippi Rivers. Floodplains, backwaters, chutes, sloughs, islands, sandbars, and main channel waters formed the large-river ecosystem that provided macrohabitat requirements for pallid sturgeon and other native large-river fish. These habitats were historically in a constant state of change. Mayden and Kuhajda (1997) describe the natural habitats to which the pallid sturgeon is adapted as: braided channels, irregular flow patterns, flooding of terrestrial habitats, extensive microhabitat diversity and turbid waters.

The historic floodplain habitat of the Missouri and Mississippi Rivers provided important functions for the native large-river fish. Floodplains were the major source of organic matter, sediments and woody debris for the mainstem rivers when floodflows crested the river's banks. The transition zone between the vegetated floodplain and the main channel included habitats with varied depths described as chutes, sloughs or side channels. The chutes or sloughs between the islands and shore were shallower and had less current than the main channel. These areas provide valuable diversity to the fish and probably served as nursery and feeding areas for many aquatic species (Funk and Robinson 1974). The still waters in this transition zone allowed organic matter accumulations, important to macroinvertebrate production. Both shovelnose sturgeon and pallid sturgeon have a high incidence of aquatic invertebrates in their diet (Carlson et al. 1985, Gardner and Stewart 1987). Floodflows connected these important habitats and allowed fish from the main channel to utilize these habitat areas to exploit available food sources.

PROPOSED PROJECT FEATURES

The preferred plan for the Schenimann Chute HREP includes five parts: (1) cutting notches in existing old stone dikes and a pile dike, (2) construction of hard points, (3) construction of stone revetment, (4) dredging the lower end of the chute, and (5) construction of a chevron south of the lower end of the chute. A total of nine alternatives were considered with various combinations of the above listed features.

METHODOLOGY

The Schenimann Chute wildlife and fishery habitats were analyzed by using a combination of the Aquatic Habitat Appraisal Guide (AHAG) and the Fish Habitat Appraisal Guide (FHAG). The target species analyzed included the shovelnose sturgeon, paddlefish, sauger, smallmouth buffalo and flathead catfish. Habitat Suitability Index models were developed for the river otter and false map turtle to determine project impacts on wildlife species. Existing conditions, future without project conditions and future with project conditions were examined. This analysis employed an interagency team with members representing the Missouri Department of Conservation, the Corps and the Service.

The evaluation models utilized produce a rating of habitat quality for each respective habitat type or species. This rating is referred to as a Habitat Suitability Index (HSI). The HSI, a value ranging from 0.1 to 1.0, measures the existing and future habitat conditions compared to optimum habitat which is 1.0. This value, when multiplied by the available habitat within the project area, will provide a measure of available habitat quality and quantity known as habitat units.

Each analysis includes limiting factors in each matrix. Absence of critical life requisites for a particular species makes the habitat unsuitable and results in a HSI value of 0.1 regardless of other habitat characteristic scores. Average annual habitat units (AAHU's) for each species are calculated to reflect expected habitat conditions over a 50-year project life. The following analysis is based on data provided by the Corps.

EXISTING AND FUTURE WITHOUT PROJECT CONDITIONS

A number of assumptions were made about what the project area and vicinity would be like 25 and 50 years in the future without any project. One assumption was that at 25 years in the future there would only be a spring connection between Schenimann Chute and the Mississippi River. At 50 years in the future the side channel would be totally disconnected from the river. The substrate and depth would become increasingly homogenized.

In the future without project condition, Schenimann Chute will become essentially unsuitable as riverine habitat for the fish species analyzed. Habitat quality for the river otter will decline in the future without project condition, essentially becoming unsuitable. Habitat quality for the false map turtle will also decline, but not to a significant degree.

FUTURE WITH PROJECT CONDITIONS

A number of assumptions were also made concerning the future with project condition. These include maintaining and improving flow and connectivity until 25 years into the future. At 50 years in the future, sedimentation will once again restrict flow and connectivity in the side

channel. The same assumptions apply to depth diversity in the side channel.

The preferred alternative (Alternative 7) will result in a net benefit of 8259 AAHU's for the fish species analyzed. This reflects a weighting factor to express the benefits of the chevron to be constructed at the lower end of Schenimann Chute. Habitat conditions remain unchanged for the river otter. Habitat conditions will improve slightly for the false map turtle with a total project benefit of 41 AAHU's with Alternative 7. Overall, the proposed project will result in a net gain of 8300 AAHU's for all species analyzed.

CONCLUSIONS AND RECOMMENDATIONS

The proposed project will be beneficial to the Middle Mississippi River by improving habitat diversity in this river reach. The project will enhance and improve depth diversity, flow and connectivity in an important side channel. Aquatic organisms will gain access to important habitat for several life stages, such as spawning, rearing and overwintering. This area will also provide an important feeding area for many species and serve as a production area for small fish and invertebrates that other species feed upon. Increased depth diversity and improved flow should elongate the life of this side channel and improve water quality. For these reasons, the project will improve habitat for the endangered pallid sturgeon and provide additional habitat for the endangered least tern, the threatened bald eagle and other large river fish species.

The habitat evaluation models utilized are useful tools for conducting incremental cost analysis. However, none of the models can truly reflect the benefits to fishery resources in the area. The proposed project supports aquatic ecosystem restoration and is in accordance with the Service's goals of habitat restoration and enhancement in the MMR. Therefore, we fully support the construction of the Schenimann Chute HREP at the earliest possible date. Thank you for the opportunity to provide this Draft Fish and Wildlife Coordination Act Report.

Sincerely,

Joyce A. Collins

Joyce A. Collins
Assistant Field Supervisor

cc: MoDOC (Christoff, Hrabik, Boone)
IDNR (Stuewe, Atwood)
USFWS (Steinbach, Surprenant)

LITERATURE CITED

Carlson, D.M., W.L. Pflieger, L. Trial, and P.S. Haverland. 1985. Distribution, biology and hybridization of *Scaphirhynchus albus* and *S. platorhynchus* in the Missouri and Mississippi Rivers. Environmental Biology of Fishes. 14:51-59.

Collot, V. 1826. A journey in North America. Arthur Bertrand, Bookseller, Paris. 2 Volumes and 1 map atlas.

Forbes, S.A., and R.E. Richardson. 1905. On a new shovelnose sturgeon from the Mississippi River. Illinois State Laboratory of Natural History Bulletin. 7(4):37-44.

Funk, J.L., and J.W. Robinson. 1974. Changes in the channel of the lower Missouri River and effects on fish and wildlife. Missouri Department of Conservation, Aquatic Series 11, Jefferson City, Missouri.

Gardner, W.M., and P. Stewart. 1987. The fishery of the Lower Missouri River, Montana. Federal Aid to Fish and Wildlife Restoration, Project F-46-R-5, Study Number 3. Montana Dept. of Fish, Wildlife, and Parks, Helena, Montana.

Gilbraith, D.M., M.J. Schwalbach, and C.R. Berry. 1988. Preliminary report on the status of pallid sturgeon, *Scaphirhynchus albus*, a candidate endangered species. Cooperative Fish and Wildlife Research Unit, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, South Dakota, Unpubl. Report.

Kallemeyn, L.W. 1983. Status of the pallid sturgeon (*Scaphirhynchus albus*). Fisheries 8(1):3-9.

Mayden, R.L., and B.R. Kuhajda. 1997. Threatened fishes of the world: *Scaphirhynchus albus* (Forbes and Richardson, 1905) (Acipenseridae). Environmental Biology of Fishes. 48:420-421.

Schmulbach, J.C., G. Gould, and C.L. Groen. 1975. Relative abundance and distribution of fishes in the Missouri River, Gavins Point Dam to Rulo, Nebraska. Proceedings South Dakota Academy of Science. 54:194-222.

Simons, D.B., S.A. Schumm, and M.A. Stevens. 1974. Geomorphology of the Middle Mississippi River. Report DACW39-73-C-0026 prepared for the U.S. Army Corps of Engineers, St.

Louis District, St. Louis, Missouri. 110 pp.

Theiling, C.H. 1999. River geomorphology and floodplain features. Pages 4-1 to 4-21 in USGS, ed., Ecological status and trends of the Upper Mississippi River System. USGS Upper Midwest Environmental Sciences Center, LaCrosse, Wisconsin. 241 pp.

Theiling, C., M. R. Craig, and K. S. Lubinski. 2000. Side Channel Sedimentation and Land Cover Change in the Middle Mississippi River Reach of the Upper Mississippi River System. USGS Upper Midwest Environmental Sciences Center, LaCrosse, Wisconsin. Final Report prepared for the U.S. Fish and Wildlife Service, Rock Island Field Office, Rock Island, Illinois. 82 pp.

U.S. Army Corps of Engineers. 2000. Sedimentation Study of the Mississippi River, Schenimann Chute, Mississippi River Miles 63.0 to 57.0, Hydraulic Micro Model Investigation. Technical Report M5. U.S. Army Corps of Engineers, St. Louis District, St. Louis, Missouri.

ST. LOUIS DISTRICT RESPONSES

TO

USFWS DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

DATED: 21 SEPT 01

USFWS COMMENT:

Based on the project's potential aquatic ecosystem restoration benefits, and its consistency with USFWS MMR habitat restoration and enhancement goals--the Service supports the construction of the Schenimann Chute HREP.

DISTRICT RESPONSE TO USFWS COMMENT:

The St. Louis District would like to thank the Service for its continuing support of the Schenimann Chute project.

APPENDIX E

HYDRAULIC MICRO MODEL STUDY

REPORT DOCUMENTATION PAGE

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5. FUNDING NUMBERS

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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13. ABSTRACT *(Maximum 200 words)*

A sedimentation study of the Middle Mississippi River, between River Miles 63 and 57, was conducted to study the sediment transport mechanics of two side channels, Schenimann Chute and Picayune Chute. A hydraulic micro model was used to assess structural design alternatives to develop physical and biological diversity within the side channels. The study concluded that favorable diversity could be achieved through the use of alternating dikes or hard-points, dredging, and notches in dikes and closure structures. The study also showed that the desired designs would not have an effect on bed response of the main commercial navigation channel.

Micro modeling is extremely small scale physical hydraulic sediment transport modeling of a river or stream.

14. SUBJECT TERMS

Mississippi River, Schenimann Chute, Micro Model, Sedimentation, Picayune Chute, Closure Structures, Side Channel, Dikes, Chutes

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Technical Report M5

SEDIMENTATION STUDY OF THE MISSISSIPPI RIVER SCHENIMANN CHUTE MISSISSIPPI RIVER MILES 63 TO 57 HYDRAULIC MICRO MODEL INVESTIGATION

By
David C. Gordon
Robert D. Davinroy

U.S. Army Corps of Engineers
St. Louis District
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Sponsored by and Prepared For:
U.S. Army Corps of Engineers, St. Louis District

In Cooperation With:
Illinois Department of Natural Resources
Missouri Department of Conservation
U.S. Fish and Wildlife Service

Final Report — May, 2000

INTRODUCTION

A sedimentation study was initiated in order to evaluate a number of environmental design alternatives and modifications in the Schenimann Chute side channel complex of the Middle Mississippi River. An expansion of the study included the upper half of Picayune Chute, which is located within the same reach. The study used a physical hydraulic micro model as a means to aid environmentalists, biologists, and engineers in creating more diverse physical and ecological habitats throughout the study reach.

The study was conducted during the period between May 1996 and July 1996 and was performed by Mr. David Gordon and Mr. Robert Hetrick, hydraulic engineers, under direct supervision of Mr. Robert Davinroy, District Potamologist for the St. Louis District. Personnel also involved with and for overseeing the study included Mr. Claude N. Strauser, Chief of the Potamology Section and Mr. Ronald Yarbrough, Avoid and Minimize Program Planner.

Personnel from other agencies involved in the study included:
Mr. Butch Atwood from Illinois Department of Natural Resources, Ms. Jenny Frazier, Mr. Bob Hrabik, Mr. Mike Peterson, and Ms. Leslie Conaway, from the Missouri Department of Conservation Long Term Research Monitoring Station, Mr. Mark Haas, Mr. Gordon Farabee, Mr. Ken Brumett, Mr. Dave Herzog and Mr. Ken Dalrymple, from the Missouri Department of Conservation, and Mr. Bob Clevenstine and Ms. Joyce Collins from the U.S. Fish and Wildlife Service.

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BACKGROUND

This report details the investigation of a sedimentation study using a physical hydraulic micro model. The micro model methodology (1) was used to evaluate the existing sediment transport conditions and the impact of various design measures to improve environmental conditions in the Schenimann Chute side channel complex on the Mississippi River.

1. Study Reach

The location of this study covered a 6-mile reach of the Middle Mississippi River, between River Miles 63 and 57, approximately 5 miles north of Cape Girardeau, Missouri. Plate 1 is a location and vicinity map of the study reach. Plate 2 is a 1994 aerial photograph depicting the study reach. Schenimann Chute is located in Cape Girardeau County, Missouri while Picayune Chute is located in Union and Alexander Counties in Illinois.

2. Problem Description

The photo on Plate 2 depicts the characteristics, configuration, and nomenclature of the Mississippi River between Miles 63 to 57. The entrance to Schenimann Chute is located near Mile 62.5R and ends near Mile 57.0R. The side channel is approximately 4.5 miles long, averages 200 feet in width, and consists of 93 acres of aquatic habitat adjacent to privately owned lands. The entrance to Picayune Chute is located near Mile 61.0L and ends below the study reach at Mile 54.8L. This side channel parallels the main channel for a distance of approximately 6.2 miles. Only the upstream 3 miles of this chute were included in the study.

The Schenimann/Picayune Chute side channel complex serves a vital role in the health of the fisheries of the Middle Mississippi River. It has been well documented that side channels, both continuous and detached, serve as important backwater habitat for a variety of fish species and are vital to the overall health of the ecosystem. These bodies of water function as spawning, rearing, resting, feeding and over-wintering habitat for numerous species of fish. With this premise it is important to note that greater physical diversity, in the form of alternating bars and deep scour holes, were desired in these side channels to create greater biological diversity.

A. History

Before 1821 and man's influence on the river, the width of the Middle Mississippi River averaged approximately 3,600 feet. Between 1821 and 1888, the Mississippi River increased in width with a resulting decrease in depth. By the end of this period, the average width of the river had increased to approximately 5300 feet (2). The width increase and subsequent decrease in depth was due to several factors. Early settlers cleared forests along the river's banklines for farmland and fuel. Fuel was needed in vast quantities for the growing number of steamboats traveling the river at the time. These acts greatly increased the erosional rates on the river's banklines, caused the river to widen excessively, and deposited unnatural quantities of material in the main river channel.

By 1881, Congress recognized that something had to be done to develop a dependable channel for navigation. The plan called for artificially restricting the river back to a more natural width and depth. The 1927 authorization assumed that a 9-foot channel depth at a minimum flow of 40,000 cfs could be maintained through the construction of channel stabilization works such as timber pile dikes and bankline revetments. The low water project flow was later revised to 54,000 cfs in 1933. By 1960, engineers recognized that pile dikes were not capable of maintaining a 9-foot channel during low flows with the designated channel width. Today, many of the deteriorated timber dikes have been replaced with stone. By

1968, Corps of Engineers construction enabled the river to return to a more natural width at an average of approximately 3,200 feet, slightly narrower than in 1821. The following table from Strauser shows that the Middle Mississippi River has been returned to more natural state (2).

YEAR	TOTAL SURFACE AREA (SQ MI)	ISLAND SURFACE AREA (SQ MI)	RIVERBED SURFACE AREA (SQ MI)	AVERAGE RIVER WIDTH (FT)
1821	109	14	95	3600
1888	163	35	128	5300
1968	100	17	83	3200

Research of historical hydrographic surveys and aerial photography has revealed that the Schenimann Chute side channel complex is a relatively newly created chute as a result of the construction of river training structures. The upstream half of the Picayune side channel complex was also a result of river training structures. Plates 3 and 4 are survey maps of the Mississippi River from 1880 and 1908. Schenimann Chute and the upstream end of Picayune chute are in the very early stages of development and are nearly nonexistent in these maps. By this period, man's influence on the river was extremely evident. The Mississippi River channel was unnaturally wide and shallow with numerous sandbars.

Aerial photographs from 1932 and 1935 on Plate 5 show newly constructed river training structures on both the Missouri and Illinois banklines. In 1932, the initial stages of the side channel formation were just beginning in the upper reaches of Schenimann chute. The 1935 photograph shows a rapid development of the upper portion of the chute. Within a short 3-year time period a large portion of the upper side channel had been formed. By 1965 (Plate 6), Picayune Chute was fully developed while the lower reach of Schenimann Chute was still maturing. Plate 2 shows that each complex is now fully developed with one dominant side channel for each.

B. Schenimann Chute

Although Schenimann Chute is long and narrow, there is a fair amount of physical diversity throughout the side channel. A couple of bends located near the upstream end of the chute and several closure structures located along the chute have created both shallow and deep areas. Two narrow entrances to the chute exist at the upstream end near Miles 62.5 and 62.2 (Plate 7). A small tributary, Bainbridge Creek, enters the chute near the upstream end. A 1996 site visit revealed several vertical eroding bank lines, exposed rock closure structures with head differences over each, several submerged remnant wooden closure structures, a few deep holes, and some shallow, flat, homogenous areas.

The three main rock closure structures were originally formed by Dikes 59.8R, 58.7R, and 58.2R, which were constructed before the island and side channel formed. Several wooden pile dikes were constructed from the original right descending bankline of the main channel, which is now the right descending bankline of the side channel. Some of the dikes extended nearly 3500 feet into the main channel. The island now covers the middle portion of the dikes. The ends of the dikes have since been rock covered and extend into the main channel. The beginnings of each dike now act as closure structures in the side channel. Each of the large, rock closure structures in the chute forms both a large scour hole and a vertical round-out in the bankline on the downstream side (Plate 8). The structures also inhibit boat access during periods of low water.

C. Picayune Chute

Picayune Chute borders Devils Island along the length of the side channel. The riverbed of the chute is relatively shallow and homogenous throughout most of the upper end of the chute. A large sand bar occupies the entrance to the chute, which prevents access to the upstream end of the chute during low water conditions (Plate 7). The upstream portion of the chute is narrow and straight with the exception of bends near the entrance and midpoint of the chute.

D. Main Navigation Channel

The main navigation channel is lined with numerous river training structures on both riverbanks throughout most of the reach. Several dikes located on the right descending bankline extend through both the island and Schenimann Chute. These dikes created many of the closure structures located within the chute. The navigation channel has experienced only minor channel maintenance dredging between Miles 59 and 58. A bendway weir field is located on the left descending bankline at the downstream end of the study reach in a bend between Miles 57.5 and 56.0.

2. Study Purpose and Goals

The purpose of the study was to design structural modifications to enhance the physical diversity and flow dynamics within the Schenimann Chute side channel complex. The study was performed to address two separate sediment transport issues. The first objective was to create additional environmental diversity in Schenimann Chute in the form of both shallow and deep-water environments, and to develop areas with fast and slow flow, while maintaining project depths in the main navigation channel. The second objective was to create easier accessibility into the entrance of Picayune Chute during low flows. The major consideration of this objective was to determine the impacts of this measure on depths in the main navigation channel.

The main goal was to evaluate the impacts of the alternatives, if any, on the resultant bed configuration (sediment transport response) within the Mississippi River and the adjacent side channel complexes. Creating desirable biological and physical diversity while at the same time ensuring a reliable navigation channel was the major challenge of this study. It was determined that increased physical diversity in the riverbed would lead to increases in aquatic habitat and greater overall ecological diversity within the area.

MICRO MODEL DESCRIPTION

In order to investigate the sediment transport issues described previously, a physical hydraulic micro model was designed and constructed. Plate 9 is a photograph of the hydraulic micro model used in this study.

1. Scales and Bed Materials

The micro model insert was constructed according to 1994 high-resolution aerial photography of the study reach and placed in a standard micro model hydraulic flume. The model employed a horizontal scale of 1 inch = 400 feet, or 1:4800, and a vertical scale of 1 inch = 50 feet, or 1:600, for an 8 to 1 distortion ratio of linear scales. This distortion supplied the necessary forces required for the simulation of sediment transport conditions similar that of the prototype. The bed material was granular plastic urea, Type II, with a specific gravity of 1.23.

2. Appurtenances

Flow in the model was simulated and regulated electronically by a function generator interfaced to a submersible bilge pump. In all model tests, the effective discharge or hydrograph was simulated automatically with the electronic control system. Each hydrograph was a repeatable triangular response representative of a range of low to high flows within the channel. Peak flow in the model represented an elevation near to bankfull flow in the prototype. The recurrence interval of bankfull flow in the prototype is approximately 1.5 years (3). Resultant bed configurations were measured and recorded with a computer interfaced 3-dimensional mechanical digitizer.

MICRO MODEL TESTS

1. Calibration and Verification

The calibration/verification of the micro model involved the adjustment of water discharge, sediment volume, hydrograph time scale, floodplain slope, and entrance conditions of the model. These parameters were refined until the measured bed response of the model was similar to that of the prototype.

A. Design Hydrograph

In all model tests, the effective discharge or design hydrograph was simulated (1) in the Mississippi River channel. This hydrograph served as the average design flow response. Because of the constant variation experienced in the prototype, a design hydrograph was used to theoretically analyze the average expected sediment transport response during any given year. This hydrograph represented a cycle of flows between extreme low flow to a within-bank high flow. The time increment or duration of each cycle (peak to peak) was three minutes.

B. Prototype Data and Observations

Data available from the prototype used for the calibration process included historic and recent hydrographic surveys, historic aerial photography, and on-site field inspections.

Plates 10, 11 and 12 are plan view hydrographic survey maps of the Mississippi River from 1989, 1993, and 1995/96, respectively. Each survey shows that the channel thalweg was located along the right descending bank at the entrance to Schenimann Chute. Near Mile 61.5, a crossing existed with depths near -10 feet LWRP. Here the channel transitioned to the left descending bank just upstream of the entrance to Picayune Chute. The channel created a deep thalweg against

the bank and the dikes with depths near -30 feet LWRP. A long crossing then developed back to right descending bank between Miles 60.0 and 59.0. Depths in this area ranged between -10 and -20 feet LWRP. The channel then crossed back to the left descending bankline between Miles 59.0 and 58.0. Depths in this crossing were near -10 feet LWRP. The channel then remained on the outside of the bend throughout the remainder of the study reach.

Plate 12 contains high-resolution hydrographic sweep surveys of Schenimann and Picayune Chutes from 1995 and 1996. These surveys showed areas of deep water exist near the entrance to Schenimann Chute and on the outside of the bends in the upper reaches of the side channel. Downstream of the bends, the geometry of the chute was relatively straight and shallow. The only depth diversity through this reach was created by the closure structures. Large, deep scour holes existed downstream of closure structures 59.8R, 58.7R, and 58.2R. The banklines downstream of each structure had been rounded out and were actively caving. Except for these few areas of scour, elevations in the chute were generally near 0 feet LWRP.

The bathymetry of Picayune Chute showed the bed to be rather homogenous throughout the upper reaches. Elevations were generally between 0 and –10 feet LWRP. The entrance to the chute was relatively shallow with elevations near 0 feet LWRP. Depth diversity in this side channel was nearly non-existent except for an area of scour near Mile 58.3.

2. Base Test

Once the favorable comparison of model tests and field survey data was made, the model was considered calibrated. The resultant survey of this bed response served as both the verification and base test of the micro model (1). Several different physical combinations of parameters were tested to develop sediment

transport conditions considered to be representative of those experienced in the prototype.

Plate 13 shows the resultant bed configuration of the micro model base test. This survey served as the comparison survey for all future design alternative tests. The base test was developed from the simulation of successive design hydrographs until bed stability was reached and a similar bed response was achieved as compared with the prototype surveys.

Results of the base test indicated the following trends:

- At the upper end of the study reach, near Mile 62.5 and the entrance to Schenimann Chute, the thalweg was positioned along the right descending bankline. A short crossing to the left descending bankline was located near Mile 61.7.

- The thalweg, with depths near –50 feet LWRP, remained along the left descending bankline from Mile 61.5, passed the entrance to Picayune Chute, to Mile 60.5. A crossing to the right descending bankline was located between Miles 60.5 to 60.0.

- The thalweg remained along the right descending bankline for a short distance before another crossing back to the left descending bankline between Miles 59.5 and 59.0.

- The thalweg remained along the left descending bankline throughout the remainder of the study reach. Depths were very shallow between Miles 58.3 and 57.5.

- Both Schenimann and Picayune Chutes had depths generally near 0 feet LWRP, as shown in the prototype surveys. Some scour was evident near the bends and main closure structures within Schenimann Chute.

3. Alternative Plans

After discussions with partnering agencies, four alternative design plans were tested in the model. As previously discussed, all tests were initiated to create environmental diversity and enhancements while at the same time ensuring the integrity of the navigation channel. The effectiveness of each plan was gaged by comparing the resultant bed configuration to that of the base test condition.

Representatives of the aforementioned agencies experimented with a variety of environmental design alternatives in the micro model. The following designs were further examined by engineers.

Alternative 1: *75-Foot Wide, 10-Foot Deep Notch Placed in Dike 61.0L*
Plate 14 is a plan view contour map of the resultant bed configuration of Alternative 1. Results of this test indicated that a notch in Dike 61.0L did not deepen the shallow area located at the upstream end of Picayune Chute. The design showed that depths in the main navigation were also unaffected.

Alternative 2: *Dike 62.5R Angled Downstream*
Plate 15 is a plan view contour map of the resultant bed configuration of Alternative 2. Results of this test indicated that angling Dike 62.5 downstream created shallower depths in the main channel upstream and downstream of the structure. The purpose of the design was to divert additional flow into Schenimann Chute when the dike was overtopped. However, the design did not impact the flow or bed response in the side channel.

Alternative 3: *75-Foot Wide, 10-Foot Deep Notch Placed in Dike 62.5R*

Plate 16 is a plan view contour map of the resultant bed configuration of Alternative 3. Results of this test indicated that placing a notch in Dike 62.5R created shallower depths in the main navigation channel just upstream of the structure. The results showed that the notch did not have an effect on the bed response in the entrance or upper portion of Schenimann Chute.

Alternative 4: *15 Dikes or Hard-Points Built to Top of Bank Elevation With Lengths Ranging From 50 Feet to 125 Feet Long Placed in Schenimann Chute Between Miles 60.5 and 59.0. Artificial Dredge Cuts at a Depths near –10 Feet LWRP Simulated in Lower End of Schenimann Chute Between Miles 58.7 to 57.0*

Plate 17 is a plan view contour map of the resultant bed configuration of Alternative 4. Results of this test indicated that each dike created a localized scour hole. The entire dike field created an alternating pattern of small scour holes and depositional bars therefore enhancing the physical diversity within the side channel. The depth of the scour was moderate and did not effect the overall average depth of the side channel through this reach. The structures also created a sinuous flow pattern of fast and slow velocity areas.

The test also revealed that the artificial dredge cut at the lower end of the side channel did not fill with sediments due to the low energy experienced at the end the chute created by the backwater effect of the main channel. These modifications had no effect on the bed response in the main navigation channel.

CONCLUSIONS

1. Summary of Model Tests

The following is a summary of findings and recommendations of the model study:

- A 75-foot wide notch placed in Dike 61.0L, at the entrance to Picayune Chute did not effect the bed response of the navigation channel. However, a notch in this location could be useful for better accessibility for boats entering the side channel from the upper end.

- Changes in the alignment and notches in Dike 62.5R at the entrance to Schenimann Chute had negative effects to the main channel. Modifications to this structure caused deposition in the navigation channel that could halt commercial navigation and require future dredging. The design did not divert additional flow into the side channel and the bed response within the chute remained unchanged by the modifications.

- The addition of several alternating hard-points or dikes in the middle of Schenimann Chute created additional physical diversity in the bed of the channel. Areas of alternating scour holes and depositional areas as well as areas of fast and slow velocity flow were created by a series of these structures.

- Depths in the lower end of Schenimann Chute were maintained after material was artificially removed and several flow events had taken place in the model. The model tests indicated that the Mississippi River main channel formed a backwater area at the lower end of the side channel. This area experienced less sediment transport because of lower energy and velocity of

flow. Therefore, dikes, which need energy to move sediment, did not work as well in this area as artificially dredging deep areas to create habitat. Artificial dredge cuts in this area may remain for several years.

2. Recommended Solutions

Plate 18 shows the recommended design to enhance the Schenimann Chute side channel complex. Model tests indicated that the following recommendations did not effect the bed response in the main navigation channel.

1. Construct a 75-foot wide, 10-foot deep notch in Dike 61.0L to enable better accessibility into Picayune Chute.

2. The upper reaches of Schenimann Chute, between Miles 62.2 and 60.6, should be left unmodified. This reach contained adequate diversity because of the numerous bends located in this area.

3. Construct a series of 15 alternating dikes or hard-points to an elevation near top of bank in Schenimann Chute between Miles 60.5 to 59.0 to create additional physical and biological diversity.

4. Artificially dredge numerous areas in the lower end of Schenimann Chute between Miles 58.7 and 57.0 to create additional deep water habitat

5. Widen and deepen the existing notches in closure structures 59.8R, 58.7R, and 58.2R to allow better accessibility throughout Schenimann Chute. Although this design was not model tested, it will not have an effect on the side channel or main navigation channel. Experience shows that a slight enlargement of these notches for boat and fish passage will not change the hydraulics or sediment transport characteristics of the reach.

In the interpretation and evaluation of the results of the tests conducted, it should be remembered that the results of these model tests were qualitative in nature. Any hydraulic model, whether physical or numerical, is subject to biases introduced as a result of the inherent complexities that exist in the prototype. Anomalies in actual hydrographic events, such as prolonged periods of high or low flows are not reflected in these results, nor are complex physical phenomena, such as the existence of underlying rock formations or other non-erodible variables. Flood flows were not simulated in this study.

BIBLIOGRAPHY

1. Davinroy, Robert D., Physical Sediment Modeling of the Mississippi River on a Micro Scale, University of Missouri-Rolla Theses, Rolla, Missouri, October 1994.

2. Strauser, Claude N., P.E., L.S., Restoration of the Middle Mississippi River by Army Engineers, 1978.

3. Leopold, Luna B., A View of the River, Harvard University Press, Cambridge Massachusetts, London, England, 1995.

FOR MORE INFORMATION

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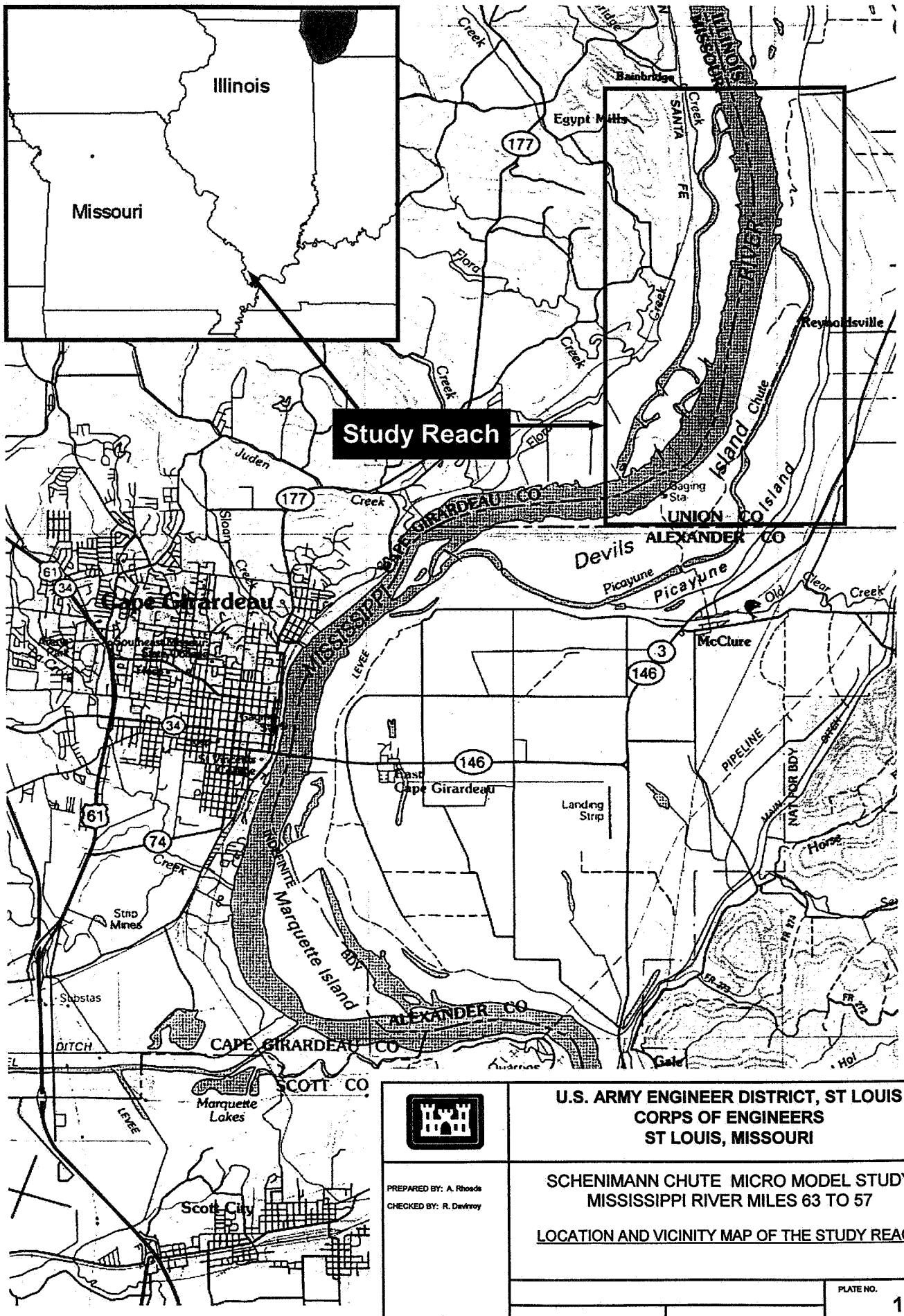
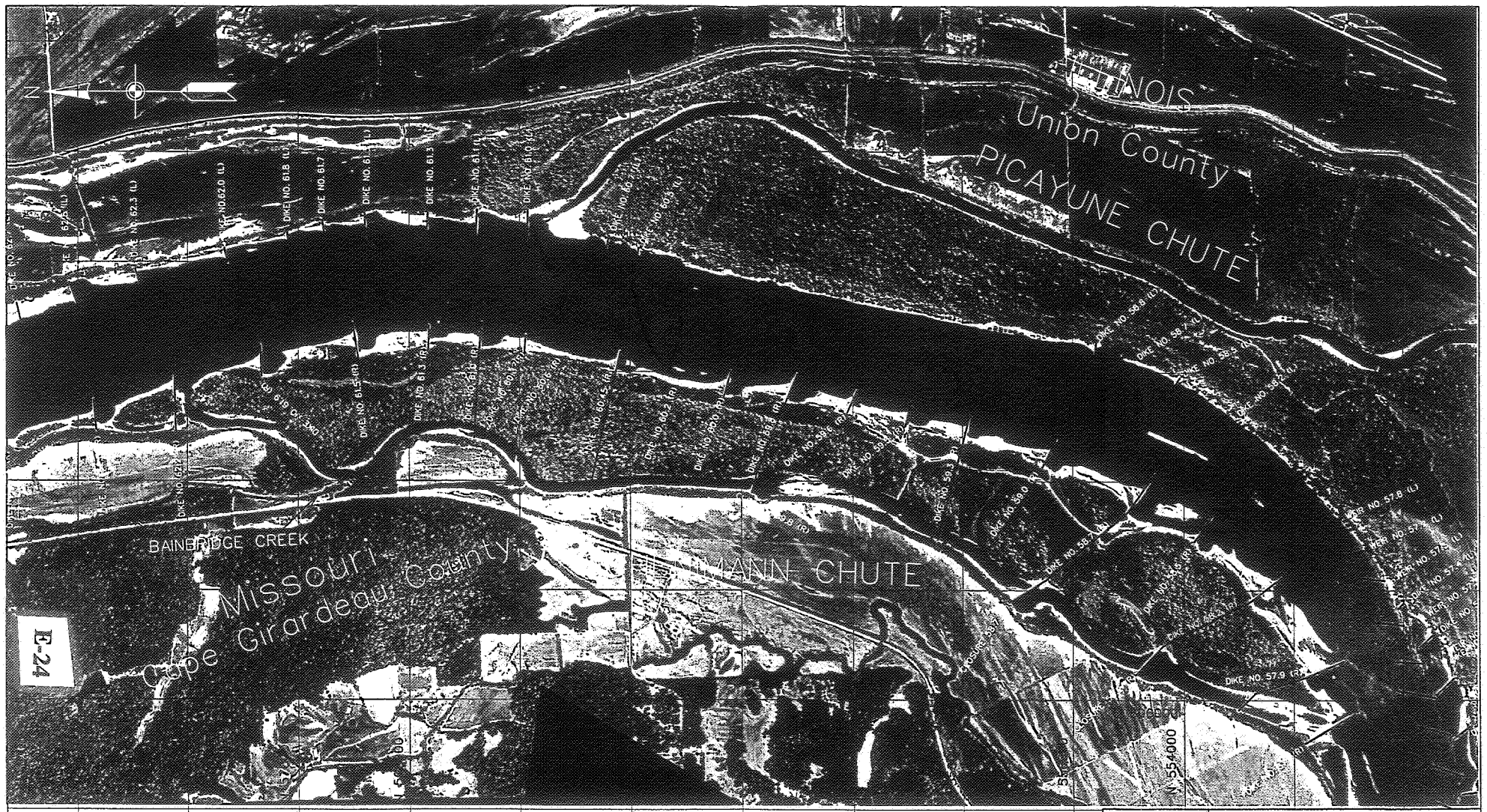
APPENDIX

Plate #'s 1 through 18 follow:

1. Location and Vicinity Map of the Study Reach
2. 1994 Aerial Photograph, Nomenclature & Characteristics of the Study Reach
3. 1880 Historic Survey Map
4. 1908 Historic Survey Map
5. 1932 and 1935 Aerial Photographs
6. 1965 Aerial Photograph
7. Field Photos
8. Field Photos
9. Schenimann Chute Micro Model
10. 1989 Prototype Survey
11. 1993 Prototype Survey
12. 1995 & 1996 Prototype Surveys
13. Micro Model Base Test
14. Alternative 1
15. Alternative 2
16. Alternative 3
17. Alternative 4
18. Design Recommendations



	U.S. ARMY ENGINEER DISTRICT, ST LOUIS CORPS OF ENGINEERS ST LOUIS, MISSOURI
PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 LOCATION AND VICINITY MAP OF THE STUDY REACH
	PLATE NO. 1



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DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY
DATE: MAY, 2000

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SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
1994 AERIAL PHOTOGRAPH

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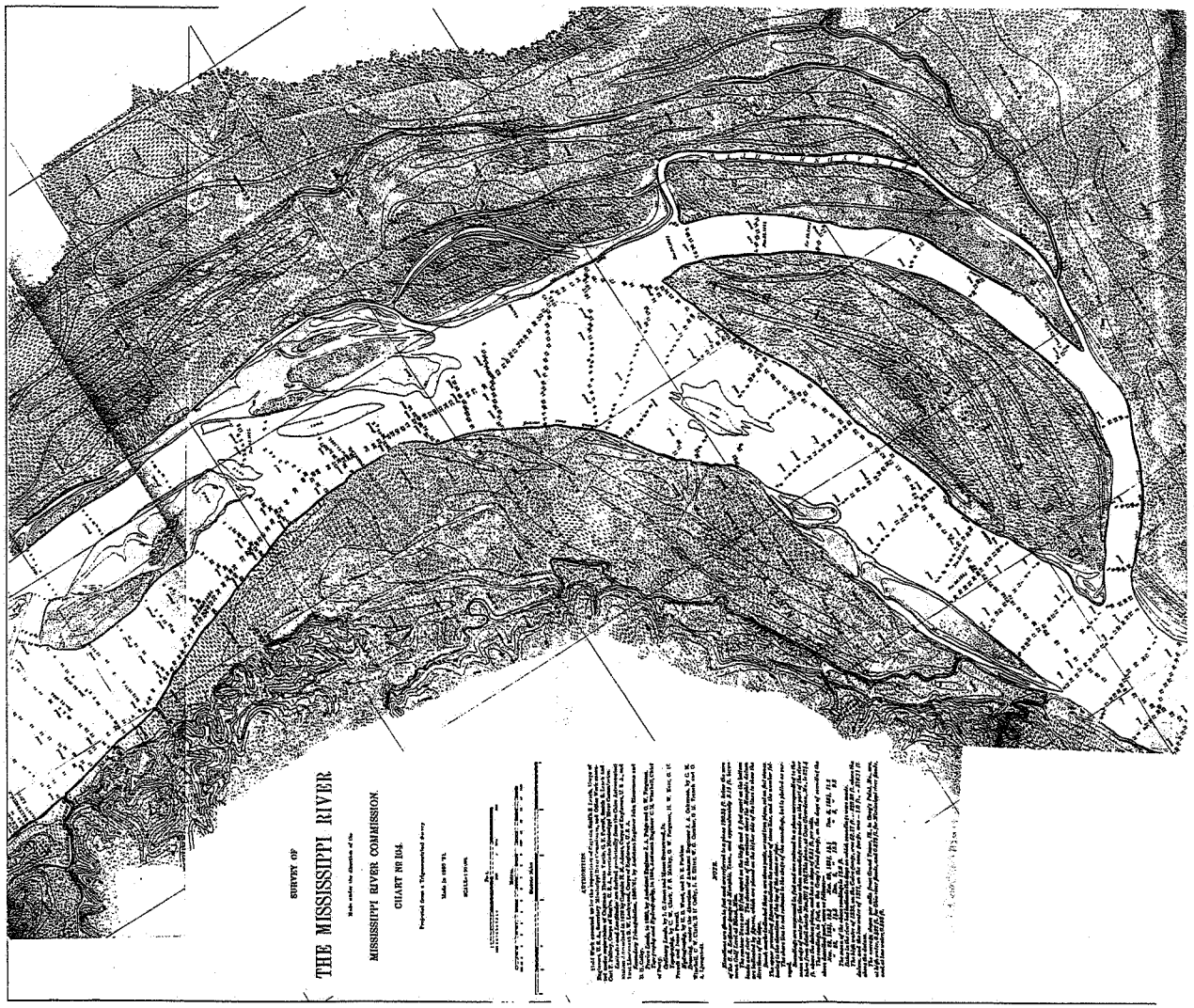
PLATE NO. 2



1880 Historic Survey Map of the Mississippi River

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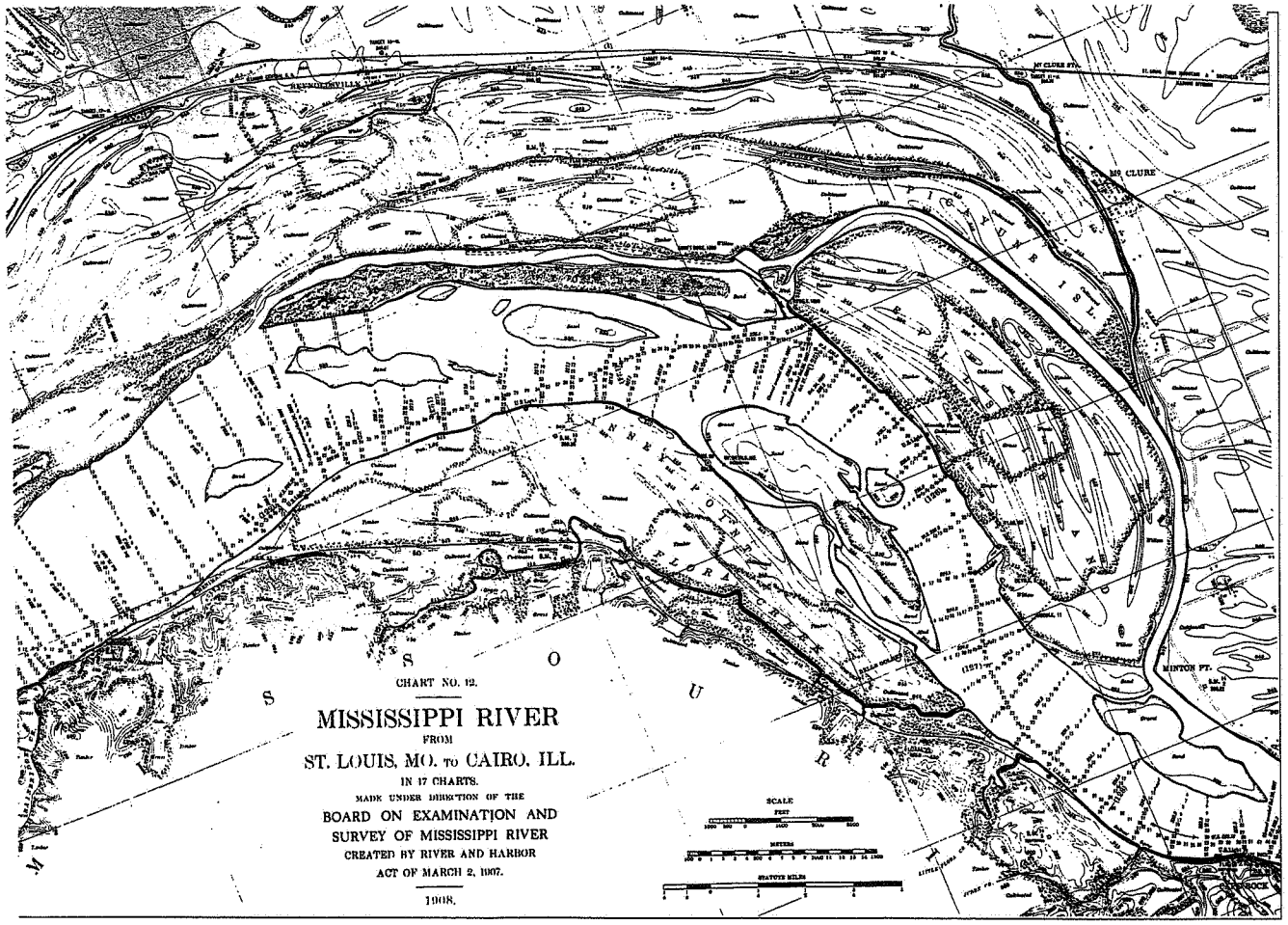
PREPARED BY: D. Gordon DRAWN BY: A. Rhoads CHECKED BY: R. Dewbrey	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 1880 HISTORIC MAP
	PLATE NO. 3



1908 Historic Survey Map of the Mississippi River

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PREPARED BY: D. Gerdes DRAWN BY: A. Rhoads CHECKED BY: R. Dedrick	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 1908 HISTORIC MAP
	PLATE NO. 4

1932 Aerial Photograph

1935 Aerial Photograph

E-27

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SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57

1932 AND 1935 AERIAL PHOTOGRAPHS

PLATE NO. 5

03 August 1965 Aerial Photograph

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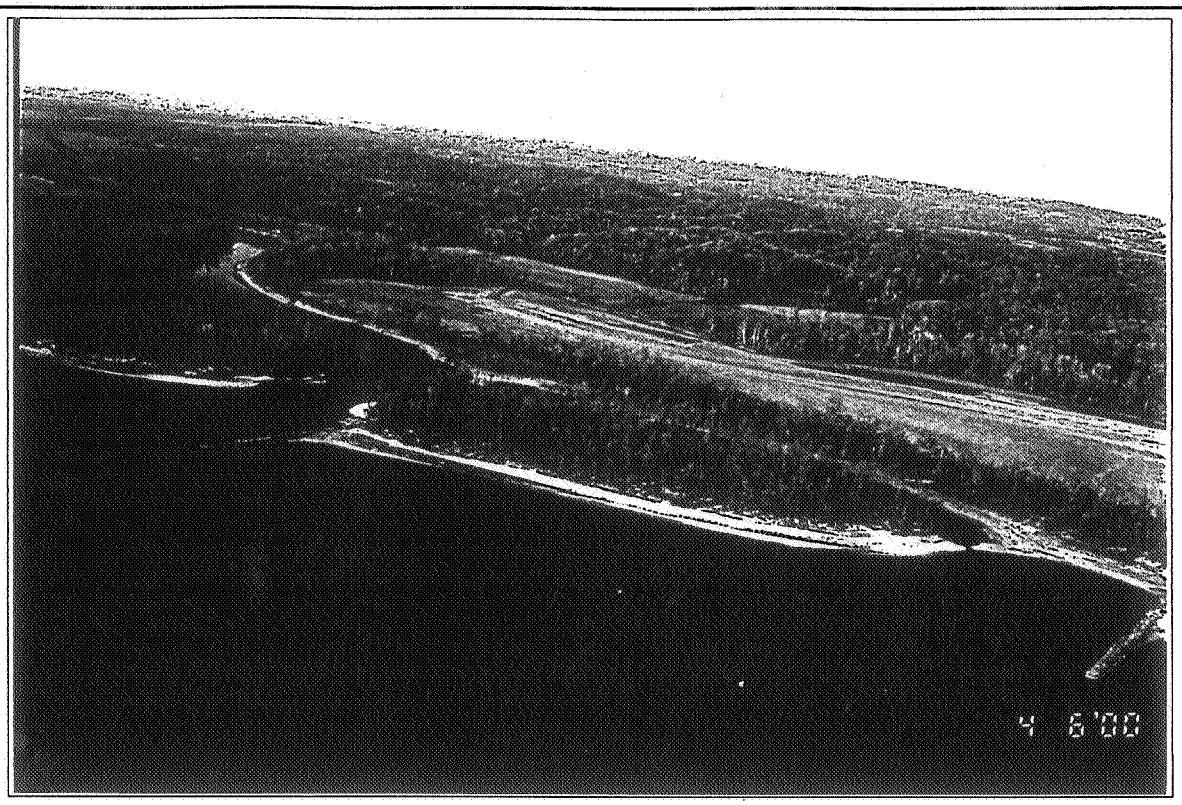
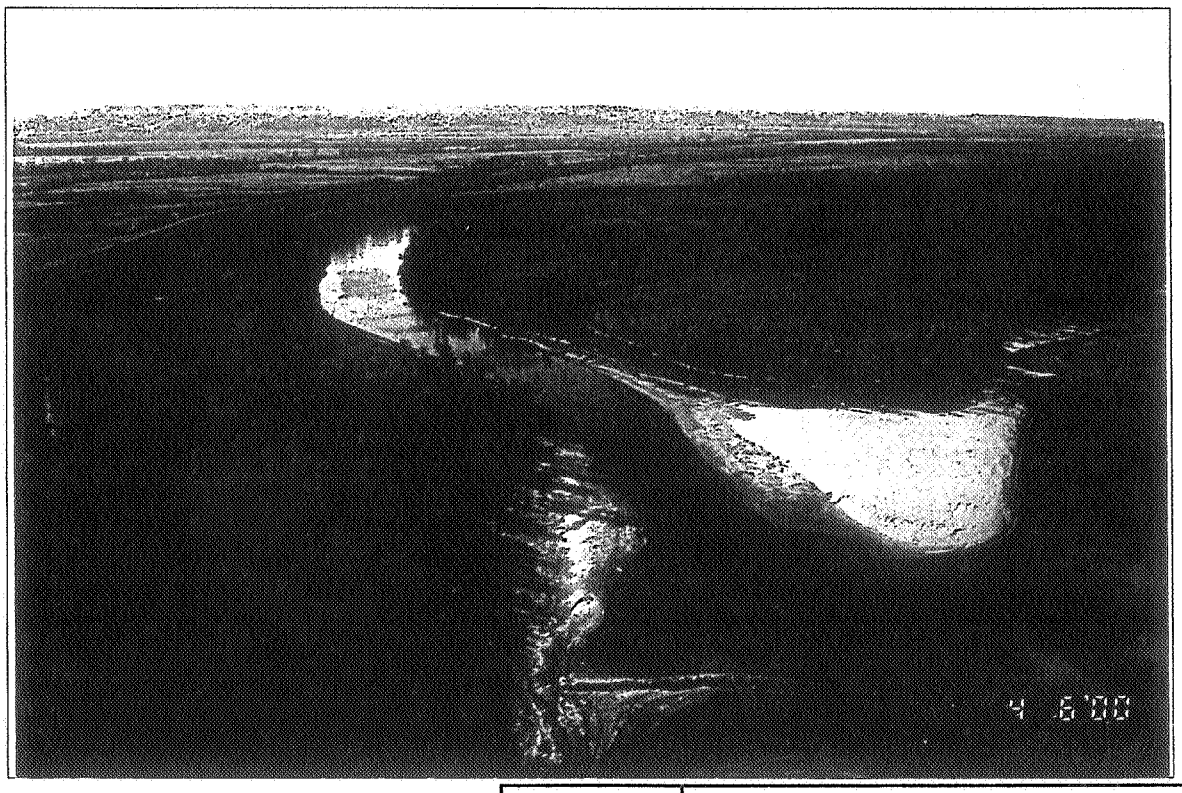
PREPARED BY: D. Gordon DRAWN BY: A. Rhoads CHECKED BY: R. Devinroy	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 1965 AERIAL PHOTOGRAPH
	PLATE NO. 6





Top Photograph: Upstream Entrance to Schenimann Chute (06 April 2000)

Bottom Photograph: Upstream Entrance to Picayune Chute (06 April 2000)

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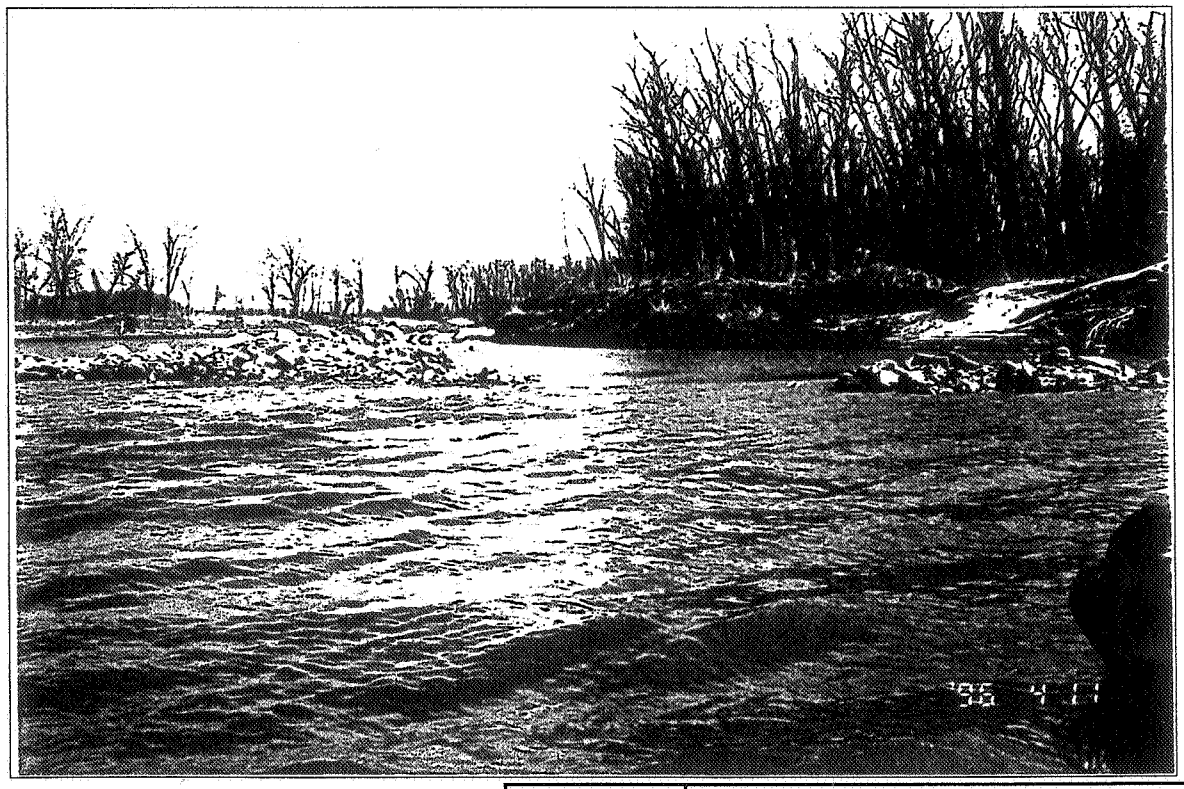
PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 FIELD PHOTOGRAPHS
	PLATE NO. 7



Top Photograph: Rock and Wood-Pile Closure Structures in Downstream End of Schenimann Chute (23 Sept. 1998)

Bottom Photograph: Notched Closure Structure 58.2(R) in Schenimann Chute (11 April 1996)

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PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 FIELD PHOTOGRAPHS
E-30	PLATE NO. 8

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PREPARED BY: A. Rhoads CHECKED BY: R. Davinroy	SCHENIMANN CHUTE MICRO MODEL STUDY MISSISSIPPI RIVER MILES 63 TO 57 SCHENIMANN CHUTE MICRO MODEL
E-31	PLATE NO. 9

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SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57

1989 PROTOTYPE SURVEY

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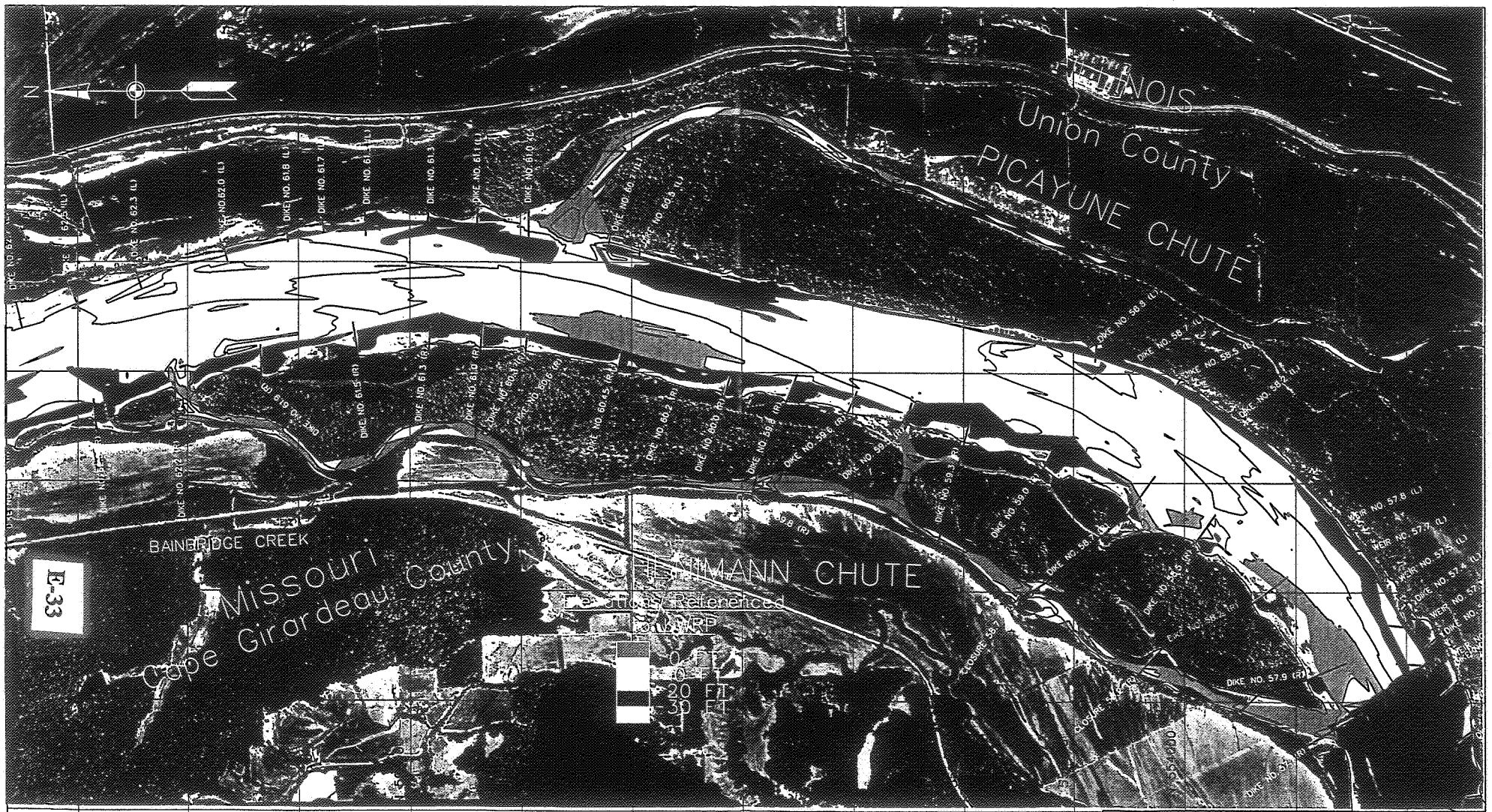

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SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
1993 PROTOTYPE SURVEY

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DESIGN FILE: sf93wrv.dgn
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PLATE NO. 11

MAIN CHANNEL RANGE SURVEY: 18 & 19 FEB 1995

SCHENIMANN CHUTE SWEEP SURVEY: 09 MAY 1995

PICAYUNE CHUTE SWEEP SURVEY: MAY 1996

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DATE: MAY, 2000

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SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
1995 & 1996 PROTOTYPE SURVEYS

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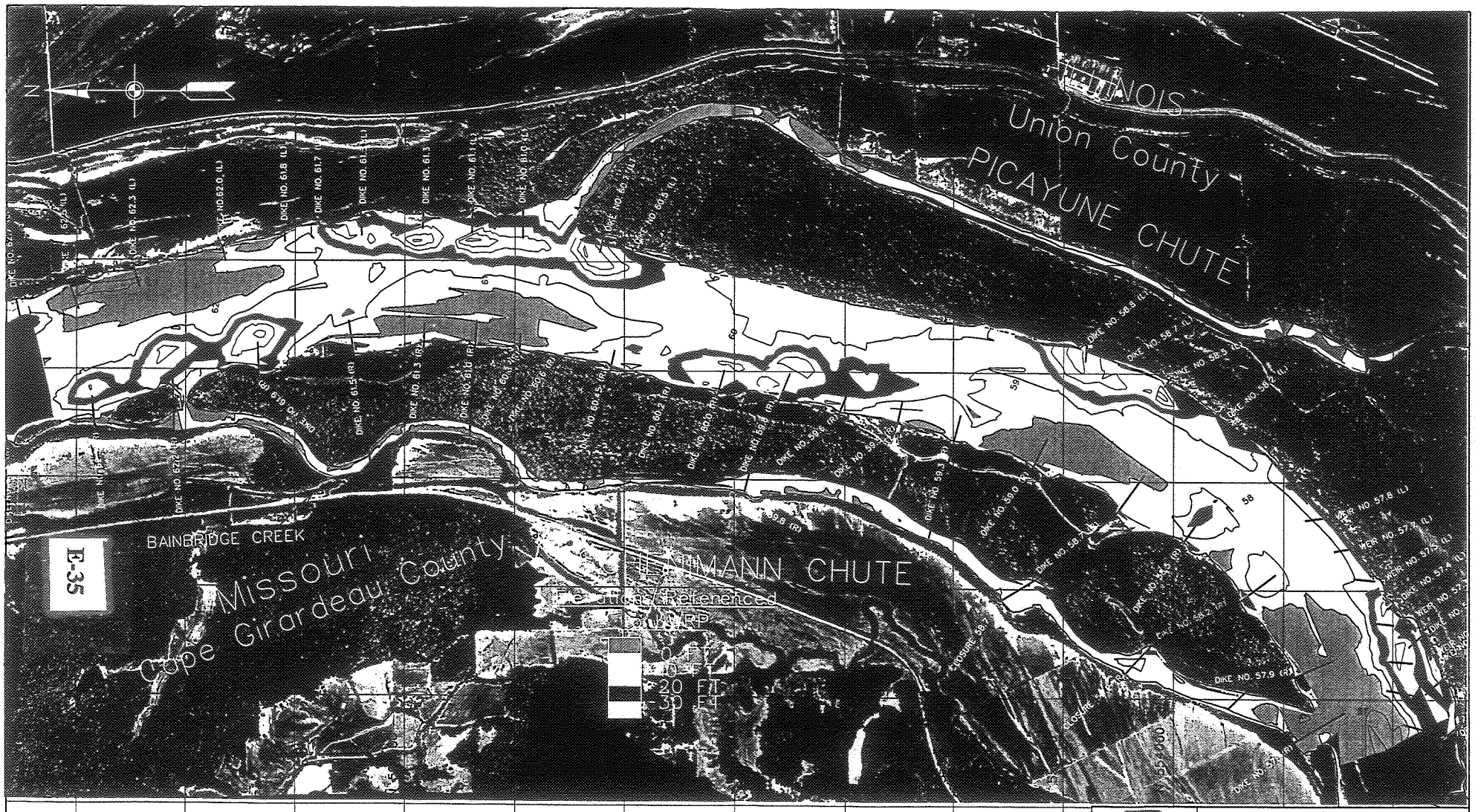
DESIGN FILE: sf95surv.dgn
PLOT SCALE: 1" = 1700'
PLOT DATE: 5/00

PLATE NO. 12



U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY
DATE: MAY, 2000

SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
BASE TEST

1700 1275 850 425 0 850 1700

DESIGN FILE: baseteat.dgn
PLOT SCALE: 1" = 1700'
PLOT DATE: 5/00

PLATE NO. 13

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
ALTERNATIVE 1

1700 1275 850 425 0 850 1700

E-36

DESIGN FILE: altern1.dgn
PLOT SCALE: 1" = 1700'

PLATE NO. 14

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

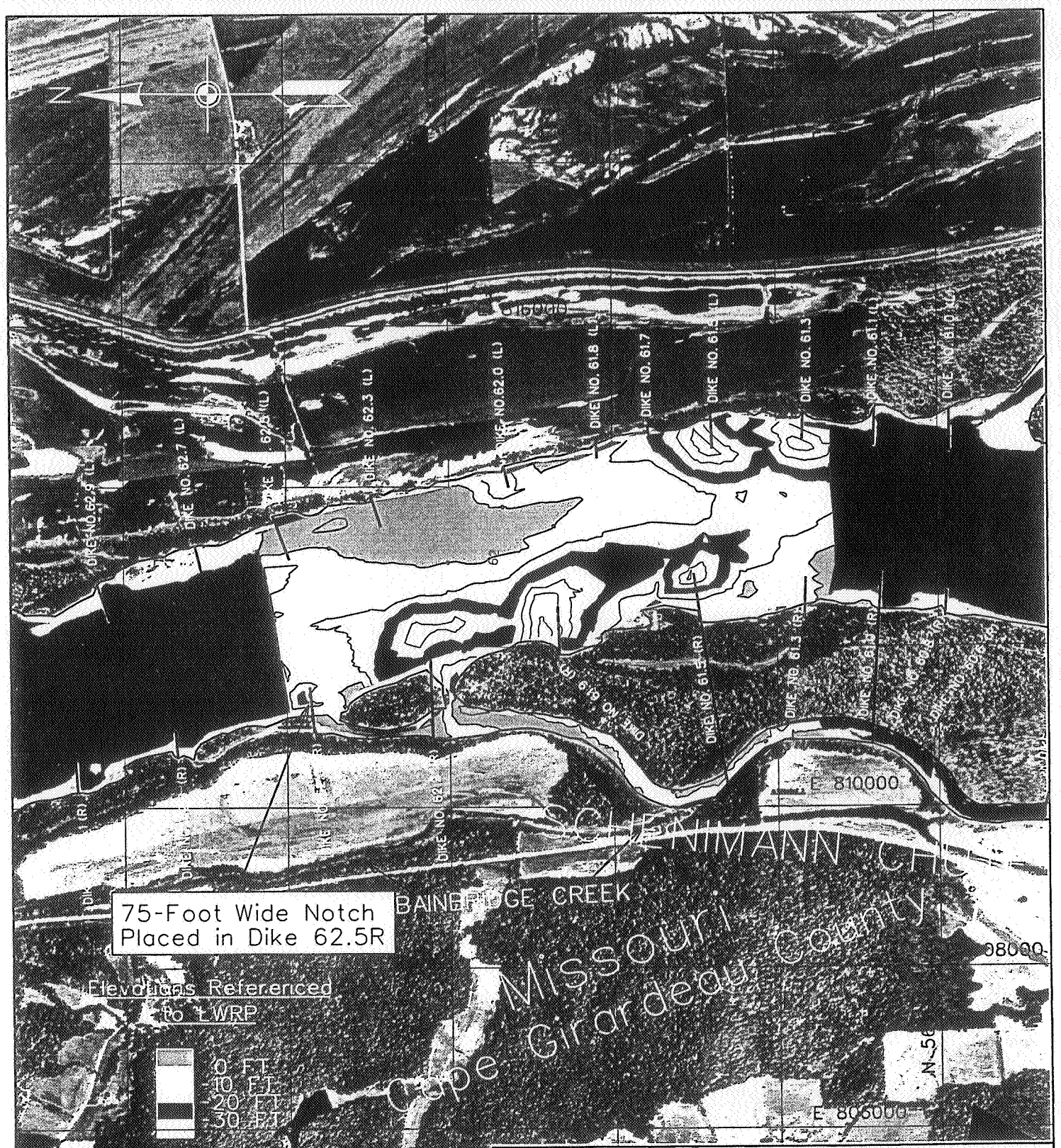
DATE: MAY, 2000

SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
ALTERNATIVE 2

1700 1275 850 425 0 850 1700

DESIGN FILE: altern2.dgn
PLOT SCALE: 1" = 1700'

PLATE NO. 15



U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY

DATE: MAY, 2000

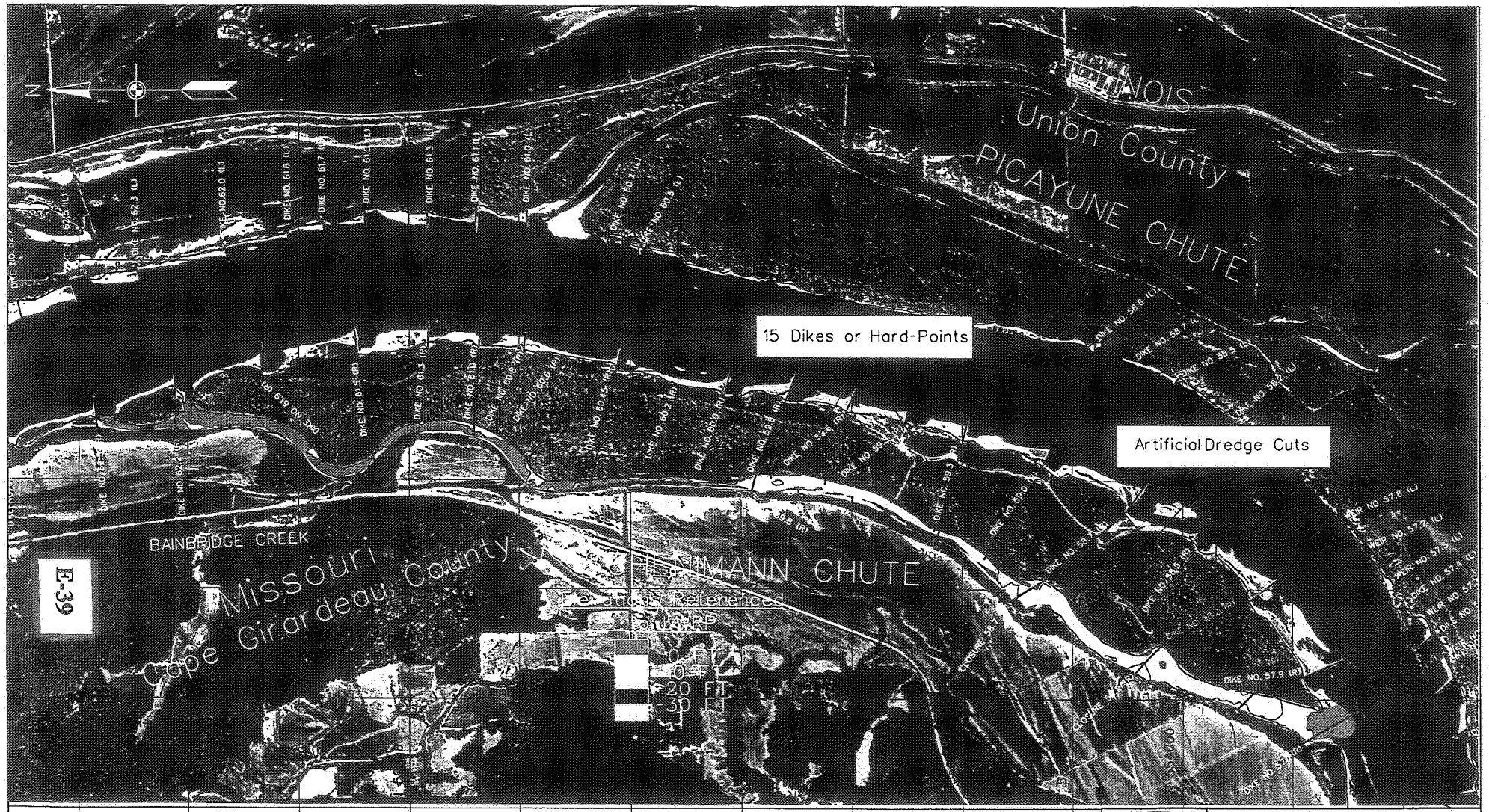
SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
ALTERNATIVE 3

1700 1275 850 425 0 850 1700

E-38

DESIGN FILE: altern3.dgn
PLOT SCALE: 1" = 1700'

PLATE NO. 16



U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVARROT
DATE: MAY, 2000

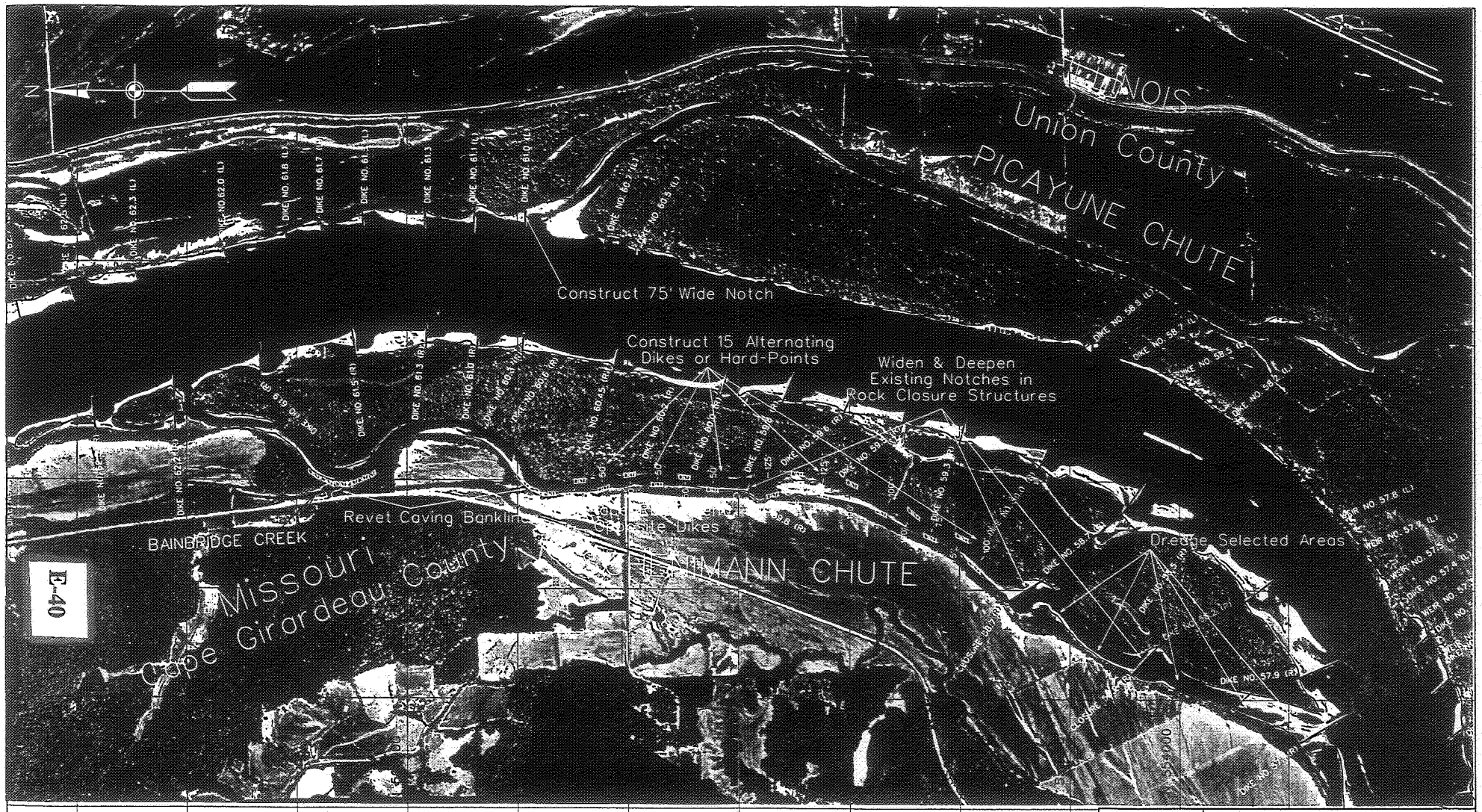
SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57

ALTERNATIVE 4

1700 1275 850 425 0 850 1700

DESIGN FILE:
PLOT SCALE: 1" = 1700'
PLOT DATE: 3/00

PLATE NO. 17



U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI

PREPARED BY: D. GORDON
DRAWN BY: A. RHOADS
CHECKED BY: R. DAVINROY
DATE: MAY, 2000

SCHENIMANN CHUTE MICRO MODEL STUDY
MISSISSIPPI RIVER MILES 63 TO 57
DESIGN RECOMMENDATIONS

1700 1275 850 425 0 850 1700

DESIGN FILE:
PLOT SCALE: 1" = 1700'
PLOT DATE: 5/00

PLATE NO. 18